REPORT DOCUMENTATION PAGE

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AASERT-~~98~~ STRUCTURAL CHARACTERIZATION OF ARTIFICIAL CORROSION AND TUNNEL JUNCTION

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F49620-~~97-1-041~~ 98-1-0418

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Professor Chad A. Mirkin

5d. PROJECT NUMBER
3484

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7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)

Northwestern University
Department of Chemistry
2145 Sheridan Road
Evanston, IL 60208-3113

NL

8. PERFORMING ORGANIZATION REPORT

9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES)

DEPARTMENT OF THE AIR FORCE
AIR FORCE OFFICE OF SCIENTIFIC
RESEARCH (AFMC) AFOSR/NL
110 Duncan Avenue, Room B115
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13. SUPPLEMENTARY NOTES

14. ABSTRACT

The goals of the proposed research were to: 1) develop novel Raman-based spectroscopic methods for characterizing corrosion barrier layers prepared from self-assembled monolayers (SAMs); these methods rely on Au colliods as Raman enhancers, and 2) use in situ atomic force microscopy to study the corrosion inhibition effects of organic monolayers on superconductors.

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16. SECURITY CLASSIFICATION OF:	17. LIMITATION OF ABSTRACT	18. NUMBER	19a. NAME OF RESPONSIBLE PERSON: Dr. Chad A. Mirkin

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Structural Characterization of Artificial Corrosion and Tunnel Junction Barrier Layers

AFOSR Contract #: F49620-~~97-1-041~~
98-1-0418

Principle Investigator: Chad A. Mirkin

Institution: Northwestern University
Chemistry Department
2145 Sheridan Road
Evanston, IL 60208

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Objectives:

The goals of the proposed research were to: 1) develop novel Raman-based spectroscopic methods for characterizing corrosion barrier layers prepared from self-assembled monolayers (SAMs); these methods rely on Au colliods as Raman enhancers, and 2) use in situ atomic force microscopy to study the corrosion inhibition effects of organic monolayers on superconductors.

Status of effort: The project has been completed.

Accomplishments/New Findings: The project resulted in the characterization of the primary binding mode of alkylamines to the surfaces of HTSC substrates. In addition, it showed that one could profoundly increase the stability of HTSCs, with respect to susceptibility to corrosion, by using hydrophobic linear alkanes that form crystalline SAMs on the surfaces of such substrates. In addition, we developed a general way of using colloidal gold coatings to extract valuable spectroscopic information (SERS) from HTSC modified substrates.

Personnel Supported:
Adam Eisenberg
Martin Masar
Ann Eidelman

Publications:

Xu, F.; Chen, K.; Mirkin, C. A.; Ritchie, J. E.; McDevitt, J. T.; Cannon, M. O.; Kanis, D. The Surface Coordination Chemistry of $YBa_2Cu_3O_{7-\delta}$, *Langmuir* **1998**, 14, 6505-6511.

Walter, D. G.; Campbell, D. J.; Mirkin, C. A. Photon-Gated Electron Transfer in Two-Component, Self-Assembled Monolayers, *J. Phys. Chem. B* **1999**, 103, 402-405.

Xu, F.; Zhu, J.; Mirkin, C. A. "Monolayer Growth and Exchange Kinetics For Alklyamines on the High Temperature Superconductor $YBa_2Cu_3O_{7-\delta}$", *Langmuir* **1999**, 16, 2169-2176.

Mirkin, C. A. "Tweezers for the Nanotool Kit", *Science* **1999** *286,* 2095- 2096.

Patents:

McDevitt, John T.; Mirkin, Chad A. **Precise molecular-level control over the interfacial properties of high-Tc superconductor structures and devices.** U.S. (1998), 14 pp. CODEN: USXXAM US 5846909 A 19981208 CAN 130:59968 AN 1998:790395 CAPLUS

Interactions/Transitions:

Scientists from *Conductus, Inc.* evaluated the use of ourt monolayer technology for stabilizing their HTSC devices and concluded that there were substantial benefits.

Honors Awards:

2001 Leo Hendrik Baekland Award (NU, 2001)
Crain's Chicago Business "40 under 40 Award" (NU, 2001)
Discover 2000 Award for Technological Innovation (NU, 2000)
Elected Fellow of the American Association for the Advancement of Science (NU, 2000)
I-Street Magazine's Top 5 List for Leading Academics in Technology (NU,2000)
Materials Research Society Young Investigator Award (NU, 1999)
ACS Award in Pure Chemistry (NU, 1999)
PLU Fresenius Award (NU, 1998)
E. Bright Wilson Prize, Harvard University (NU, 1998)